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should have a number called *infinity*." "If we write the smallest decimal fraction possible . . . we have a decimal fraction called zero." "We might be required to find the value of the fraction  $\frac{.0001}{.0003}$ , which we cannot do satisfactorily without knowing what the next decimal figures should be."

The reviser was undoubtedly annoyed, as the reader of the work will surely be, at the attempt to use the old plates with the new. The break in the styles of type is quite noticeable (v. pp. 64, 79, 129, 133, *et passim*), while lack of uniformity in the length of the pages (*e. g.*, pp. 74 and 75, 80 and 81, 82 and 83, etc.) and the imperfections in the old plates (*e. g.*, pp. 84, 121, etc.) detract considerably from the appearance of the work.

The Algebra for Beginners has not been so thoroughly revised as the Elementary Algebra. It differs little from the English edition save as to the applied problems. Here the difference in the monetary standards has made a number of changes necessary, and in these cases the difference in the typography is unpleasantly noticeable. Although quite elementary, the work is so much superior to several popular American text-books for beginners that it is to be hoped that it may find a place in our schools.

David Eugene Smith

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*Introduction to Elementary Practical Biology, a Laboratory Guide for High-School and College Students.* By CHARLES WRIGHT DODGE, Professor of Biology in the University of Rochester. pp. xv+422. Harper and Brothers. New York. 1894.

As stated by the author in the preface, this book is not a text-book in the ordinary sense of the word, but has to do entirely with the actual work of a laboratory. The purposes of laboratory study are thus admirably stated: (1) To teach the student to observe correctly; (2) to distinguish essential from non-essential facts; (3) to draw proper conclusions from the facts observed, and (4) to express in writing and by means of drawings the results obtained. To develop these powers in biology the work is fairly evenly divided between botany and zoölogy, and "consists essentially of questions on the gross and minute structure, and on the physiology of a series of common animals and plants which are typical of their kind,—

questions which can be answered only by actual examination of the specimens, or by the performance of the experiments."

The study is begun with the simplest or unicellular animals and plants, and with the cellular elements of higher forms, then for the biology of the animal the following are considered : Sponge, fresh-water polyp, campanularian hydroid, star-fish, earth-worm, lobster or cray-fish, locust (grasshopper), fresh water mussel, and frog. For the biology of the plant the author has selected the following : Green felt, stonewort, rockweed, mould, mushroom, liverwort, fern, and a flowering plant, as the bean.

The work has the admirable feature of combining the study of the structure and the function together. Indeed the student is advised to have a living specimen before him while dissecting a dead one so that there may be kept constantly in mind the purpose of the different structures. One might as well set the pupils at Chinese puzzles as anatomy unconnected with physiology. The directions for the student have the clearness characteristic of a teacher thoroughly familiar with the difficulties met by beginning students, and while they are full they are so carefully given that the learner must use his own best efforts to attain the end. The chapter on the locust (grasshopper) is especially to be commended. The insects form so large a part of the animal kingdom and have such intimate relations with plant life that it is a source of surprise that they have not formed a part of every work on biology for the training of students. It seems to the reviewer also that it is a serious mistake to devote so much attention to the invertebrates and to ignore the group of mammals to which the student himself belongs. If a mammal like the cat, closely resembling man in structure and food, were studied there would be the added interest arising from personal grounds. Certainly as all biology teaches *purpose*, the student, stimulated by a definite, practical, and personal interest, will give closer attention than when the connection with himself and his interests is more remote. It is hoped that in a future edition the author will add a mammal to his already well selected series.

No figures are given, but doubtless the author would agree that visual aids are of the greatest help and should be supplied by the teacher in his lectures and discussions.

In a book of instruction the arrangement of the matter is of prime importance. In this one the simple is placed first and

the pupil is gradually introduced to that which is more and more complex. This is the order followed by his prototype, the *Biology of Huxley and Martin*, in the first edition, but reversed in the second edition. At the first glance the question of arrangement seems simple enough, and doubtless most teachers would agree with the author that the simple should precede the complex; but, as in so many cases, two principles come into collision here. The complex forms, flowering plant, frog, etc. are more or less familiar to the pupil, while the simple forms are of microscopic size and wholly unknown to him. In taking the simple first, then, the student must study what is wholly unknown and in addition make use of a microscope and interpret the appearances through it. Dr. Dodge has duly considered this matter in his book and states that the chapters are so far independent that they may be taken up as best suits the teacher. He justifies the order from the simple to the complex rather than from the known to the unknown by the following very clever statement which is not easily controverted: "As a matter of fact beginning students have no more real knowledge of the higher [complex] than of the lower [simple] forms."

A commendable feature of the book is the reference to special works relating to the different forms studied. If in the questions the student finds those apparently wholly unanswerable from his present knowledge he is liable to be stimulated to investigate the matter further, and in the special works a great new world will be opened up to him. For example, if his own investigations are inadequate,—as they certainly will be,—to answer many of the questions, as that on. p. 25 *b*, ("of what use could this property—[*i. e.* the property of ingestion of foreign particles—] of the cell be in the frog?"), he will naturally turn to some of the larger special works, and they will give him a glimpse of the vast fields to be explored and thus stimulate his intellect and arouse his enthusiasm.

Probably no teacher of experience would affirm that any subject whatsoever appeals to all minds no matter how well presented by book and teacher; but for those minds with a special taste for biology or of such perfection that every subject is interesting, books like this are sure to serve as the most efficient agents in education, for they make the subject real and thus give the pupils a notion of how the splendid results of the great masters are attained.

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